**TASK BASED MATHEMATICS LESSON PLAN**

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**1) Information**

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| Name of the lesson: Horses and Chickens | Concept/Topic: Algebraic Thinking and Systems of Linear Equations |
| **Grade Level**: 4 - Algebra 1 | Goals and learning objectives: Students will demonstrate how to make connections between the numerical sense, diagrams and algebraic representations of a mathematical task that spans various grade levels. |

### 2) Standards Progression:

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| **97 CA Math Standards** | Common Core Content Standards: |
| **2nd grade**  Statistics, Data, and Probability    2.0 Students demonstrate an understanding of patterns and how patterns grow and describe them in general ways:  2.1 Recognize, describe, and extend patterns and determine a next term in linear patterns (e.g., 4, 8, 12 . . . ; the number of ears on one horse, two horses, three horses, four horses).  2.2 Solve problems involving simple number patterns. |  |
| **3rd grade**  Algebra and Functions    2.0 Students represent simple functional relationships:    2.1 Solve simple problems involving a functional relationship between two quantities (e.g., find the total cost of multiple items given the cost per unit).  2.2 Extend and recognize a linear pattern by its rules (e.g., the number of legs on a given number of horses may be calculated by counting by 4s or by multiplying the number of horses by 4). |  |
| **4th grade** Number Sense  4.0 Students know how to factor small whole numbers:    4.1 Understand that many whole numbers break down in different ways (e.g., 12 = 4 × 3 = 2 × 6 = 2 × 2 × 3). | 4.OA - Use the four operations with whole numbersto solve problems.2.Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison. 3.Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding and explain why a rounded solution is appropriate. |
| **5th grade** Algebra and Functions  1.0 Students use variables in simple expressions, compute the value of the expression for specific values of the variable, and plot and interpret the results:  1.1 Use information taken from a graph or equation to answer questions about a problem situation.  1.2 Use a letter to represent an unknown number; write and evaluate simple algebraic expressions in one variable by substitution.  1.3 Know and use the distributive property in equations and expressions with variables.  1.4 Identify and graph ordered pairs in the four quadrants of the coordinate plane.  1.5 Solve problems involving linear functions with integer values; write the equation; and graph the resulting ordered pairs of integers on a |  |
| **6th Grade** Algebra and Functions  1.0 Students write verbal expressions and sentences as algebraic expressions and equations; they evaluate algebraic expressions, solve simple linear equations, and graph and interpret their results:  1.1 Write and solve one-step linear equations in one variable.  1.2 Write and evaluate an algebraic expression for a given situation, using up to three variables. | **6.EE - Represent and analyze quantitative relationships between dependent and independent variables**  Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation to represent the relationship between distance and time. |
| **7th grade** Number Sense 1.0 Students know the properties of, and compute with, rational numbers expressed in a variety of forms: 1.2 Add, subtract, multiply, and divide rational numbers (integers, fractions, and terminating decimals) and take positive rational numbers to whole-number powers.  **Algebra and Functions** 1.0 Students express quantitative relationships by using algebraic terminology, expressions, equations, inequalities, and graphs: 1.1 Use variables and appropriate operations to write an expression, an equation, an inequality, or a system of equations or inequalities that represents a verbal description (e.g., three less than a number, half as large as area A). | 7.EE - Solve real-life and mathematical problems using numerical and algebraic expressions and equations. 4. Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.  a) Solve word problems leading to equations of the form px + q = r and p(x + q) = r, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?  b) Solve word problems leading to inequalities of the form px + q > r or px + q < r, where p, q, and r are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. For example: As a salesperson, you are paid $50 per week plus $3 per sale. This week you want your pay to be at least $100. Write an inequality for the number of sales you need to make, and describe the solutions. |
|  | **8.EE - 6. Analyze and solve pairs of simultaneous linear equations.**  a.Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.  b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. For example, 3x + 2y = 5 and 3x + 2y = 6 have no solution because 3x + 2y cannot simultaneously be  5 and 6.  c. Solve real-world and mathematical problems leading to two linear equations in two variables. For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair. |
| **Algebra 1:**  1.0 Students identify and use the arithmetic properties of subsets of integers and rational, irrational, and real numbers, including closure properties for the four basic arithmetic operations where applicable:    1.1 Students use properties of numbers to demonstrate whether assertions are true or false.  9.0 Students solve a system of two linear equations in two variables algebraically and are able to interpret the answer graphically. Students are able to solve a system of two linear inequalities in two variables and to sketch the solution sets. | **A-REI - Solve systems of equations**  5. Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.  6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.  7. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line y = –3x and the circle x^2 + y^2 = 3. |
| **Mathematical Reasoning** 2.0 Students use strategies, skills, and concepts in finding solutions: 2.3 Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning.  2.4 Express the solution clearly and logically by using the appropriate mathematical notation and terms and clear language; support solutions with evidence in both verbal and symbolic work. 3.0 Students move beyond a particular problem by generalizing to other situations: 3.1 Evaluate the reasonableness of the solution in the context of the original situation.  3.2 Note the method of deriving the solution and demonstrate a conceptual understanding of the derivation by solving similar problems.  3.3 Develop generalizations of the results obtained and apply them in other circumstances. | **Standards of Mathematical Practice:**  1 Make sense of problems and persevere in solving them.  2 Reason abstractly and quantitatively.  3 Construct viable arguments and critique the reasoning of others.  8 Look for and express regularity in repeated reasoning. |

#### 3) Prerequisites:

#### What do the students need to know prior to the lesson?

#### That chickens have two legs and horses have four legs.

* + Various strategies for solving problems: numerical reasoning, logical reasoning, charts/tables, look for a pattern, solve a simpler problem, such as guess and check, drawing diagrams, working backwards...

* What vocabulary do we need to think about?
* What do students struggle with? What are their misconceptions prior to the lesson?

**4) Required Materials:**  Chart Paper, Markers

**5) Resources:** *Fostering Algebraic Thinking*, Mark Driscoll 1999; *Selecting and Creating Mathematical Tasks: From Research to Practice*, Margaret Schwan Smith and Mary Kay Stein, 1998

**6) Process of the lesson:**

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| **Steps/Time** | **Learning Activities and Teachers’ Questions** | **Anticipated Student Responses and Misconceptions** | **Teacher’s response to student reactions / Things to remember** | **Checking for Understanding (Evidence of Student Learning)** |
| Introduction  (5 min) | Read task together, ensuring that all students understand what is being asked.  What do you know?  What is implied? | There are only chickens, because the question only asks about chickens. |  |  |
| Independent Work Time  (10 min) | Students work quietly on the task independently using any strategy they chose. They record their efforts on a piece of paper. | Students will not make the connection that they also need to check the total number of legs, once they find a combination that works for the number of heads. | Students will not keep their work organized to clearly explain their thinking. |  |
| Guided Discovery – groups of 3 or 4  (20 min) | Students compare efforts and explain their reasoning to others in their group. They compare and contrast strategies that were used, extending their own problem solving strategies. Students choose one to share with the whole group. They create a poster for the whole class to analyze. | Some students may believe that there is only one way to access the problem and discount another student’s attempt. | Teacher strategically examines all student work and guides groups in deciding which to portray on a poster so that various strategies are represented for the whole group to compare and contrast. |  |
| Whole Group  (20 min) |  |  |  |  |
| Closure  (5 min) |  |  |  |  |

**8) Plan for Independent Practice/Homework:**

**9) Adaptations/Extensions:**

**10) Possible connection to other subjects and or mathematical concepts:**